REMARKS:

Minor changes are made to this specification. Claim 2 is canceled without prejudice. Claims 1, 7 and 9 are amended; marked up versions of the amended claims are attached hereto pursuant to 37 C.F.R. § 1.121(c)(ii). Claims 1 and 2-12 are pending in the application. Reexamination and reconsideration of the application, as amended, are respectfully requested.

Claim Rejections –35 U.S.C. § 102

Claims 1 and 4 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Komeichi et al. (JP 3-155176). Claim 1 has been amended. Applicant respectfully submits that this rejection has been rendered moot by the amendment of claim 1. Specifically, Applicant has amended claim 1 to include the limitations of claim 2, and claim 2 has been cancelled without prejudice. The office does not contend that prior claim 2 is anticipated by Komeichi et al. As such, claim 1 is now not anticipated for the same reasons as prior claim 2. Withdrawal of the rejection is respectfully requested.

Claim 1 further stands rejected under 35 U.S.C. § 102(b) as being anticipated by Yasuda et al. (U.S. Patent No. 4,845,399). Claim 1 has been amended. Applicant respectfully submits that this rejection has been rendered moot by the amendment of claim 1. Specifically, Applicant has amended claim 1 to include the limitations of claim 2, and claim 2 has been cancelled without prejudice. The office does not contend that prior claim 2 is anticipated by Komeichi et al. As such, claim 1 is now not anticipated for the same reasons as prior claim 2. Withdrawal of the rejection is respectfully requested.

Claims 1-4 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Someji et al. (U.S. Patent No. 5,254,212). Claim 2 has been cancelled without prejudice. Claim 1 has been amended include the limitations of claim 2. Applicant respectfully traverses the rejection as to the amended claims.

The present invention is directed to a laminated piezo-electric device, and specifically to a piezo-electric device that is particularly desirable for use in fuel

injection devices for automobiles, for positioning devices used for precision equipment and as a drive device for preventing vibration. (Specification, at p. 1, lines 5-11.)

As amended, claim 1 of the present invention is as follows:

1. A laminated piezo-electric device comprising:

a pole-like laminate formed by alternately laminating piezo-electric layers and electrode layers in the direction of height;

a pair of outer electrode plates formed on the different side surfaces of said pole-like laminate, a pair of neighboring electrode layers having said piezo-electric layer sandwiched therebetween being electrically connected at their side surfaces to the outer electrode plates which are different from each other;

flexible protruded electrically conducting terminals on the side surfaces of said pole-like laminate on where the outer electrodes are arranged, said flexible protruded electrically conducting terminals extending along the side surfaces of the electrode layers and adapted for following the stretching and contraction of said pole-like laminate in the direction of height thereof,

wherein the electrode layers are joined to said outer electrode plates via said protruded electrically conducting terminals, and

wherein a glass layer is formed on the side surfaces of said pole-like laminate on where the outer electrodes are arranged to as to cover the side surfaces of the piezo-electric layers, and the root portions of said protruded electrically conducting terminals are buried in said glass layer.

As described in Applicant's Specification, the protruded electrically conducting terminals 5 are formed by applying a paste comprising chiefly an electrically conducting metal such as silver or silver alloy onto the side surface of the inner electrode layers 2 that are to be connected to the outer electrodes 4. (See Figure 1). (Specification, p. 14, line 35- p.15, line 6. By applying the paste to the side surfaces of the inner electrode layers 2 to the vicinities therefore followed by firing, silver that diffuses less into the piezo-electric layer 1 diffuses into the side surfaces of the inner electrode layers 2 and is collected thereby to form the protruded electrically conducting terminals 5 that extend along the side surfaces of the inner electrode layers 2. (Specification, p. 15, lines 10-17.) The protruded electrically conducting terminals 5 thus formed are buried at their root portions in the glass layer and are very strongly jointed to the side surfaces of the inner electrode layers 2. (Specification, p. 15, lines 18-21). Thus, as the laminate 50 undergoes stretching and contraction, the wires between the protruded electrically conducting terminals 5 and the inner electrode layers 2 are reliably prevented from being broken. (Specification, at p. 15, lines 21-25.)

Applicant respectfully submits that amended claim 1 patentably distinguishes over Someji et al. Amended claim 1 requires a laminated piezo-electric device having "flexible protruded electrically conducting terminals on the side surfaces of said pole-like laminate on where the outer electrodes" and "wherein a glass layer is formed on the side surfaces of said pole-like laminate on where the outer electrodes are arranged to as to cover the side surfaces of the piezo-electric layers, and the root portions of said protruded electrically conducting terminals are buried in said glass layer." Applicant respectfully submits that nothing in Someji et al. teaches or suggests a construction for a piezo-electric device as is required by amended claim 1.

Someji et al. is directed to a method of making a layered electrostrictive displacement device by forming sheets of an electrostrictive material alternately with internal electrodes. The laminate formed therefrom has two opposite surfaces at which the ends of the internal electrodes are exposed and two other opposite

surfaces at which alternate layers of the internal electrodes are exposed. In the outstanding Office Action, the Office cites Figure 14 for the proposition that "flexible protruded electrically conducting terminals (5) are provided on the side surfaces of said pole-like laminate on where the outer electrodes are arranges..." (office Action at p. 4, lines 3-5.)

Applicant respectfully submits that the Office misconstrues the teachings of Someji et al. in this instance. Figure 14 is described with respect to Example 3 of Someji et al. as follows:

> "A laminate in which alternate layers of the internal electrodes were exposed at both sides as shown in FIG. 21 was created in the same way as in Example 2. Temporary external electrodes 13 and 14 were formed on both side surfaces.
>
> The upper and lower surfaces of the laminate at which neither the temporary external electrodes nor the internal electrodes were exposed were masked. As shown in FIG. 8, the ceramic on the surface which has to be plated with a metal was etched so that the internal electrodes protruded. The laminate was immersed in 10% solution of hydrochloric acid at 50.degree. C. for 60 minutes to etch the ceramic up to a depth of 10 .mu.m.
>
> One of the side surfaces of the laminate not having the temporary external electrodes was masked with a masking reagent. Then, the opposite surface was plated with a metal in the same conditions as in the Example 2. Similarly, the side surfaces on the rear side were plated with the metal.
>
> FIG. 9 is a perspective view of the laminate plated with nickel. FIG. 10 is a fragmentary cross section. In

these figures, indicated by numeral 5 are belt-like deposits of nickel.

A shot blasting operation was effected, in the same manner as in Example 2, to form concave cutouts 15 as shown in FIG. 11. Then, as shown in FIG. 12, an insulating material 7 was applied to the shot-blasted surface and baked. Subsequently, as shown in FIG. 13, both side surfaces were lapped. The insulating layer 7 was partially removed to expose the nickel plating 5.

The laminate block fabricated in this manner was cut into individual devices, in the same way as in Example 2. Then, as shown in FIG. 14, external electrodes 9 and 10 were formed. Connection with the corresponding internal electrodes 3 and 4 could be made."

(Col. 9, line 50- col. 10, line 17, emphasis added)

Thus, the side surfaces of the piezo-electric device are lapped. As shown in Figure 13, the nickel plated deposits 5 are not protruded from the surface of the insulating material 7. As such, Someji does not teach "flexible protruded electrically conducting terminals on the side surfaces of said pole-like laminate on where the outer electrodes" as indicated by the Office and as required by claim 1. As such, Someji et al. does not teach or suggest each element of the claimed invention and withdrawal of the rejection and allowance of amended claim 1 is respectfully requested.

Further, in Figure 14 of Someji, the entire metal 5 is embedded in the insulating layer (glass layer), and therefore the forward end of the metal cannot follow the elongation and shrinkage in the height direction of the pole-like laminate. As such, the piezo-electric device may be damaged by such elongation and shrinkage. However, as shown in Fig. 2C, in the protruded electrically conducting terminal used in the present invention, the root portion is embedded in the glass layer, and only the root portion is fixed by the glass layer. Accordingly the terminal

shows sufficient flexibility that the forward end can follow the elongation and shrinkage in the height direction of the pole-like laminate and can effectively prevent damage by elongation and shrinkage. A metal 5 of Someji is thus quite different from the protruded electrically conducting terminal in which the root portion is embedded in the glass layer. As such, Applicant respectfully submits that amended claim 1 patentably distinguishes over Someji.

Claims 3 and 4 depend from claim 1 and are patentable for at least the same reasons as claim 1. Withdrawal of the rejection and allowance of claims 3 and 4 is respectfully requested.

Claim Rejections –35 U.S.C. § 103

Claims 5 and 6 stand rejected under 35 U.S.C. § 103(a) as being obvious over Someji et al. Claims 5 and 6 each depend from claim 1, and, as such, include each and every element of claim 1. As shown above, Someji does not teach "flexible protruded electrically conducting terminals on the side surfaces of said pole-like laminate on where the outer electrodes" as indicated by the Office and as required by claim 1. As such, Someji et al. does not teach or suggest each element of the claimed invention and withdrawal of the rejection and allowance of amended claim 1 is respectfully requested.

Claims 10 and 11 stand rejected under 35 U.S.C. § 103(a) as being obvious over Komeichi et al. in view of Yasuda et al. Claims 10 and 11 depend from amended claim 1 either directly or through intervening claims. As such, claims 10 and 11 include all the limitations of amended claim 1. Applicant has amended claim 1 to include the limitations of claim 2, and claim 2 has been cancelled without prejudice. The office does not contend that either Komeichi et al or Yasuda et al. teaches or suggests all the elements of prior claim 2, and as such, of amended claim 1. Specifically, nothing in the combination cited by the Office either teaches or suggests a laminated piezo-electric device "wherein a glass layer is formed on the side surfaces of said pole-like laminate on where the outer electrodes are arranged to as to cover the side surfaces of the piezo-electric layers, and the root portions of

said protruded electrically conducting terminals are buried in said glass layer" as is required by amended claim 1 (and prior claim2). Since the combination of Komeichi et al. and Yasuda et al. fails to either teach or suggest each claim limitation, the combination cannot render the claimed invention obvious. Withdrawal of the rejection and allowance of claims 10 and 11 is respectfully requested.

Claim 12 stands rejected under 35 U.S.C. § 103(a) as being obvious over Komeichi et al. in view of O'Neill (U.S. Patent No. 4,011,474). Claim 12 depends from amended claim 1. As such, claim 12 includes all the limitations of amended claim 1. Applicant has amended claim 1 to include the limitations of claim 2, and claim 2 has been cancelled without prejudice. The office does not contend that Komeichi et al teaches each claim limitation of the base claim, amended claim 1. Specifically, nothing in Komeichi either teaches or suggests a laminated piezo-electric device "wherein a glass layer is formed on the side surfaces of said pole-like laminate on where the outer electrodes are arranged to as to cover the side surfaces of the piezo-electric layers, and the root portions of said protruded electrically conducting terminals are buried in said glass layer" as is required by amended claim 1 (and prior claim2). O'Neill does not supply the missing teachings or suggestions. Since the combination of Komeichi et al. and O'Neill fails to either teach or suggest each claim limitation, the combination cannot render the claimed invention obvious. Withdrawal of the rejection and allowance of claims 10 and 11 is respectfully requested.

Allowable Subject Matter

Claims 7-9 stand objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claim. Claims 7 and 9 have been rewritten in independent form including all the limitations of their respective base claims and any intervening claims. Applicant notes that the base claim, prior claim

1, has been amended to improve readability. Withdrawal of the objection and allowance and allowance of claims 7 and 9 is respectfully requested.

The art made of record but not relied upon by the Examiner has been considered. However, it is submitted that this art neither describes nor suggests the presently claimed invention.

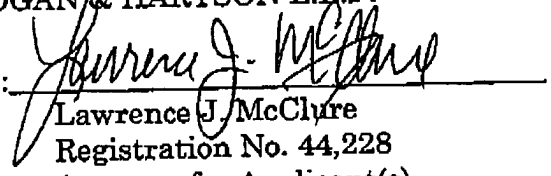
In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (213) 337-6810 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
HOGAN & HARTSON L.L.P.

Date: January 22, 2003

By: 
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Version with markings to show changes made:

1. (Amended) A laminated piezo-electric device comprising:

a pole-like laminate formed by alternately laminating piezo-electric layers and electrode layers in the direction of height[, and];

a pair of outer electrode plates formed on the different side surfaces of said pole-like laminate, [said two] a pair of neighboring electrode layers [neighboring each other with] having said [the] piezo-electric layer sandwiched therebetween being electrically connected at their side surfaces to the outer electrode plates which are different from each other;

[wherein] flexible protruded electrically conducting terminals [are provided] on the side surfaces of said pole-like laminate on where the outer electrodes are arranged, said flexible protruded electrically conducting terminals extending along the side surfaces of the electrode layers and [being capable of] adapted for following the stretching and contraction of said pole-like laminate in the direction of height thereof, [and]

wherein the electrode layers are joined to said outer electrode plates via said protruded electrically conducting terminals, and

wherein a glass layer is formed on the side surfaces of said pole-like laminate on where the outer electrodes are arranged to as to cover the side surfaces of the piezo-electric layers, and the root portions of said protruded electrically conducting terminals are buried in said glass layer.

7. (Amended) [A laminated piezo-electric device according to claim 1,] A laminated piezo-electric device comprising:

a pole-like laminate formed by alternately laminating piezo-electric layers and electrode layers in the direction of height;

a pair of outer electrode plates formed on the different side surfaces of said pole-like laminate, a pair of neighboring electrode layers having said piezo-electric layer sandwiched therebetween being electrically connected at their side surfaces to the outer electrode plates which are different from each other; and

flexible protruded electrically conducting terminals on the side surfaces of said pole-like laminate on where the outer electrodes are arranged, said flexible protruded electrically conducting terminals extending along the side surfaces of the electrode layers and adapted for following the stretching and contraction of said pole-like laminate in the direction of height thereof,

wherein the electrode layers are joined to said outer electrode plates via said protruded electrically conducting terminals, and

wherein an electrically conducting member for preventing local heat generation is provided on the outer surfaces of said outer electrode plates, and an electric current is supplied to the outer electrode plates through said electrically conducting member.

9. (Amended) [A laminated piezo-electric device according to claim 2,] A laminated piezo-electric device comprising:

a pole-like laminate formed by alternately laminating piezo-electric layers and electrode layers in the direction of height;

a pair of outer electrode plates formed on the different side surfaces of said pole-like laminate, a pair of neighboring electrode layers having said piezo-electric layer sandwiched therebetween being electrically connected at their side surfaces to the outer electrode plates which are different from each other; and

flexible protruded electrically conducting terminals on the side surfaces of said pole-like laminate on where the outer electrodes are arranged, said flexible protruded electrically conducting terminals extending along the side surfaces of the electrode layers and adapted for following the stretching and contraction of said pole-like laminate in the direction of height thereof,

wherein the electrode layers are joined to said outer electrode plates via said protruded electrically conducting terminals,

wherein a glass layer is formed on the side surfaces of said pole-like laminate on where the outer electrodes are arranged to as to cover the side surfaces of the

piezo-electric layers, and the root portions of said protruded electrically conducting terminals are buried in said glass layer,and

wherein said protruded electrically conducting terminals are formed by applying an electrically conducting paste containing a glass powder and an electrically conducting metal powder onto the side surfaces of the pole-like laminate, followed by heating.